REMARKS

Applicants thank the Examiner for the thorough examination of the application. No new matter is believed to be added to the application by this amendment.

Entry Of Amendment

Entry of this Amendment under 37 C.F.R. §1.116 is respectfully requested because it cancels claims, thereby reducing issues for appeal. Alternately, entry is requested because the Amendment places the application in condition for allowance.

Status of the Claims

Upon entry of this Amendment, Claims 3-7 and 9-21 are pending in the application. Claims 1, 2 and 8 are cancelled by this Amendment. The Examiner has withdrawn claims 3-7, 9, 14-17 and 19 from consideration.

Statement Of Substance Of Interview

The Examiner is thanked for graciously conducting a personal interview with the Applicants' representative on May 12, 2005. During the interview, the layer structure of the present invention and the technology of Doverspike (U.S.

Patent 6,459,100) were discussed. The effect of doping and the n-type and p-type layers were discussed.

At the end of the interview, the Examiner prepared an Interview Summary. The Interview Summary has been reviewed, and it appears to accurately reflect the substance of the interview.

Rejection Under 35 U.S.C. §102(b) Over Okumura

Claims 1, 2 and 8 are rejected under 35 U.S.C. §102(b) as being anticipated by Okumura (U.S. Patent 6,370,176). Applicants respectfully traverse.

Claims 1,2 and 8 are cancelled by this Amendment, thereby rendering this rejection moot.

Rejection Under 35 U.S.C. §102(b)/103(a) Over Okumura

Claim 21 is rejected under 35 U.S.C. §102(b) as being anticipated by or, alternately under 35 US.C. §103(a) as being obvious of the single reference of Okumura. Applicants traverse.

The Present Invention and its Advantages

The present invention pertains to an epitaxial substrate for a compound semiconductor light-emitting device that improves crystallinity in the vicinity of the pn junction, thereby facilitating hole injection, without degrading the light-

emitting layer structure protection performance. The invention includes a p-type layer structure formed in contact with the light-emitting layer structure, where the p-type layer structure has a triple layer construction composed of an n-type first layer, a p-type second layer and a p-type third layer. The result is excellent performance even if the layer thickness is small.

The invention finds a typical embodiment in claim 21:

> 21. (Previously Presented) An epitaxial substrate for a compound semiconductor light-emitting device comprising:
> a double-hetero light-emitting layer structure including a pn junction; and
> a p-type layer side layer structure formed in contact with the light-emitting layer structure including in order from the layer in contact with the light-emitting layer structure an n-type first layer represented by AlGaN, a p-type second layer represented by AlGaN: Mg and a p-type third layer represented by GaN: Mg, each of the three neighbors being formed in contact with its neighbor.

Distinctions of the Invention Over Okumura

Figure 1 of Okumura depicts a semiconductor laser that includes a quantum well 7 over which is consecutively found an $Al_{0.2}Ga_{0.8}N$ evaporation prevention layer 8, a p-type GaN guide layer 9 and a p-type $Al_{0.1}Ga_{0.9}N$ cladding layer 10 (see Okumura at column 7, lines 45-60). This laser of Okumura is not comparable to the AlGaN n-type first layer, AlGaN:Mg p-type second layer and GaN:Mg p-type third layer of claim 21 of the invention.

That is, Okumura at column 7, lines 56-57 states that "the $Al_{0.2}Ga_{0.8}N$ evaporation prevention layer 8 may be doped with Mg. This is advantageous

because it becomes easy to inject holes from the p-type GaN guide layer 9 and the p-type $Al_{0.1}Ga_{0.9}N$ cladding layer 10 to the MQW structure active layer 7." However, Okumura repeatedly teaches that layer 8 is an evaporation protection layer, i.e., a layer that functions as a physical barrier to prevent the evaporative deterioration of the underlying layers. Therefore, it is problematic whether the layer 8 of Okumura has any n-type or p-type function at all, and there is no indication of such in Okumura itself.

As a result, the evaporation layer 8 of Okumura cannot be compared to the n-type AlGaN first layer of claim 21 of the present invention.

Alternately, the Examiner turns to column 8, lines 25-33 of Okumura to infer that the layer is n-type when no Mg is present. However, although this passage discusses the growth of InGaN and AlGaN layers, there is no mention that Mg is absent.

As a result, Okumura fails to teach each and every element of claim 21. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Also, the Examiner uses the single reference of Okumura to assert obviousness. To establish a *prima facie* case of obviousness, "the prior art reference (or references when combined) must teach or suggest all the claim limitations." MPEP §2143. In addition, if a reference needs to be modified to achieve the claimed invention "there must be a showing of a suggestion or motivation to modify the teachings of that reference to the claimed invention in order to support the obviousness conclusion." Sibia Neurosciences Inc. v. Cadus Pharmaceutical Corp., 225 F.3d 1349, 55 USPQ2d 1927 (Fed. Cir. 2000).

Further, the Examiner turns to page 9 of the Applicants' own specification to buttress his position. However, there has been no admission as to prior art in the Applicant's disclosure. "The court must be ever alert not to read obviousness into an invention on the basis of the Applicant's own statements, that is, we must view the prior art without reading into that art appellant's teachings." In re Nomiya, 509 F.2d 566, 184 USPQ 607, 612 (CCPA 1975). Recently the Federal Circuit has reiterated that the disclosure in the specification should not be construed as prior art, stating: "One's own work may not be considered prior art in the absence of a statutory basis, and a patentee should not be 'punished' for being as inclusive as possible . . ." Riverwood International Corporation v. R.A. Jones & Co., Inc, 324 F.3d 1346, 1355, 66USPQ2d 1331, 1340 (Fed. Cir., 2003).

Okumura therefore fails to anticipate claim 21. A *prima facie* case of obviousness has not been made over claim 21. These rejections are overcome and withdrawal thereof is respectfully requested.

Rejections Under 35 U.S.C. §102(b)/103(a) Over Doverspike

Claims 10-13, 18 and 20 are rejected under 35 U.S.C. §102(b) as being anticipated by Doverspike (U.S. Patent 6,459,100). Claim 21 is rejected under 35 U.S.C. §102(b) as being anticipated by or, alternately under 35 US.C. §103(a) as being obvious of the single reference of Doverspike. Applicants respectfully traverse.

The Present Invention and its Advantages

The present invention pertains to an epitaxial substrate for a light emitting device that includes a layered structure having an n-type first layer represented by $In_xAl_yGa_zN$ ($x + y + z = 1$, $0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq z \leq 1$), an n-type second layer represented by $In_uAl_vGa_wN$ ($u + v + w = 1$, $0 \leq u \leq 1$, $0 \leq v \leq 1$, $0 \leq w \leq 1$) and a p-type third layer represented by $In_pAl_qGa_rN$ ($p + q + r = 1$, $0 \leq p \leq 1$, $0 \leq q \leq 1$, $0 \leq r \leq 1$), each of the three neighbors being formed in contact with its neighbor (see claim 10).

Fig. 1 shows a typical embodiment of the present invention, where layers 7A, 7B and 8 are the quantum well light emitting structure, respectively. Layer 10 in Fig. 1 is a non-light transmitting capping structure.

Mg doping is not absolutely necessary for the third p-type layer. Although Mg doping may be used to obtain the p-type third layer, for example, the third p-type layer may also be obtained by other means.

The three layers in claim 10 are not light emitting. The three layers serve to improve the hole injection efficiency, thereby improving the light emitting efficiency. Especially, the second layer serves to enhance the light emitting efficiency when some quantity of p-type dopant (depending upon growth conditions) is doped to control the concentration of n-type carrier to a low level.

The n-type carrier density can be controlled by the doping of the p-type dopant. For example, the density of n-type carrier will be less than 1×10^{-19} cm^{-3} when p-type dopant is doped so as to be less than 1×10^{21} cm^{-3}.

When p-type dopant is doped so as to be less than 1×10^{21} cm^{-3} , the p-type dopants enter the lattice site and the acceptor density may be less than 1×10^{-19} cm^{-3} . As a result, the layer may be not p-type, but n-type.

That is, when the dopant density is the quantity of dopant, and the acceptor density is the quantity of dopant that is displaced in the lattice site, then the carrier density is the quantity of thermally activated dopant.

Therefore, since the density of p-type dopant is independent of n-type carrier density, the different n-type carrier density may be obtained. For example, depending upon the growth conditions, even if a p-type dopant is doped with a specific p-type dopant density.

Accordingly, as shown in claim 11 of the present invention, when the p-type dopant density and the n-type carrier density are restricted, it becomes possible to provide an epitaxial substrate that has enhanced light emission efficiency.

Distinctions Of The Invention Over Doverspike

Distinctions of the invention over Doverspike have been placed before the Examiner. For brevity, these distinctions will not be repeated at length here.

Figure 1 of Doverspike shows a quantum well 12 over which is consecutively formed an undoped GaN layer 15, an undoped AlGaN layer 21 and a p-type AlGaN:Mg layer 22 (See Doverspike at column 5, lines 55-60). Doverspike fails to disclose that the undoped GaN layer 15 is n-type, and that the undoped AlGaN layer 21 is n-type.

Therefore, Doverspike fails to anticipate or suggest the invention of claim 10. Claims depending upon claim 10 are patentable for at least the above reasons.

Regarding claim 21, the Examiner turns to layers 11-15 of Fig. 1 of Doverspike. However, as noted above, Doverspike fails to disclose that the undoped GaN layer 15 is n-type, and that the undoped AlGaN layer 21 is n-type. Therefore, Doverspike fails to suggest the present invention sufficient to allege *prima facie* obviousness.

At page 3 of the Office Action impermissibly relies upon the Applicants' own disclosure:

> Arguments regarding applicant's admissions of prior art are unconvincing as undoped layers 15 and 21 of Doverspike are n-type by reason of their process of making and unless applicant can prove the contrary the rejection will stand. As stated in the rejection the process temperature for layer 15 is 750-800 degrees C and under these conditions the layer necessarily becomes n-type as there is no p-type dopant as Mg included. The burden is on applicant.

By this, the Examiner is inferring that the present invention is inherent in Doverspike and would be recognized as such by one of ordinary skill.

> To establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. *See In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51.

In this case, the Examiner fails to provide extrinsic evidence, but rather turns to the Applicants' own disclosure. Turning to the Applicants' own disclosure results in a failure of motivation to modify the prior art reference of Doverspike. "The court must be ever alert not to read obviousness into an invention on the basis of the Applicant's own statements, that is, we must view the prior art without reading into that art appellant's teachings." *In re Nomiya*, 509 F.2d 566, 184 USPQ 607, 612 (CCPA 1975) (Figures in the application

labeled "prior art" held to be admission that what was pictured was prior art relative to Applicant's invention).

Further, the Examiner turns to the single reference of Doverspike to allege obviousness. However, as discussed above, the Examiner must point out where in the reference itself the teaching or suggestion lies to modify the technology to produce the present invention.

Doverspike therefore neither anticipates nor suggests the present invention sufficient to allege *prima facie* obviousness.

These rejections are overcome and withdrawal thereof is respectfully requested.

Rejection Under 35 U.S.C §112, First Paragraph

Claims 11 and 13 are rejected under 35 U.S.C §112, first paragraph as not being enabled. Applicants respectfully traverse.

At page 4 of the Office Action, the Examiner asserts that "claim 11 states that the layer is n-type but can have the more p-type dopant than n-type dopant (carrier density). This simply is not possible."

However, as noted above, the n-type carrier density can be controlled by the doping of the p-type dopant. For example, the density of n-type carrier will be less than 1×10^{-19} cm^{-3} when p-type dopant is doped so as to be less than 1×10^{21} cm^{-3}.

When p-type dopant is doped so as to be less than 1×10^{21} cm^{-3}, the p-type dopants enter the lattice site and the acceptor density may be less than 1×10^{-19} cm^{-3}. As a result, the layer may be not p-type, but n-type.

That is, when the dopant density is the quantity of dopant, and the acceptor density is the quantity of dopant that is displaced in the lattice site, then the carrier density is the quantity of thermally activated dopant.

Therefore, since the density of p-type dopant is independent of n-type carrier density, the different n-type carrier density may be obtained. For example, depending upon the growth conditions, even if a p-type dopant is doped with a specific p-type dopant density.

Accordingly, as shown in claim 11 of the present invention, when the p-type dopant density and the n-type carrier density are restricted, it becomes possible to provide an epitaxial substrate that has enhanced light emission efficiency.

This rejection is overcome and withdrawal thereof is respectfully requested.

Prior Art

The prior art cited but not utilized by the Examiner indicates the status of the conventional art that the invention supercedes. Additional remarks are accordingly not necessary.

Information Disclosure Statements

The Examiner is thanked for considering the Information Disclosure Statement filed May 24, 2004 and for making the initialed PTO-1449 form of record in the application in the Office Action mailed September 8, 2004. The Examiner is respectfully requested to consider the Information Disclosure Statement filed August 23, 2004 and to make the initialed PTO-1449 form of record in the application in the next official action.

The Drawings

The Examiner has indicated that the drawing figures are acceptable in the Office Action mailed September 8, 2004.

Foreign Priority

The Examiner has acknowledged foreign priority in the Office Action mailed September 8, 2004.

Filing Receipt

The Examiner is respectfully requested to indicate the status of the Official Filing Receipt.

Conclusion

The Examiner's rejections have been overcome obviated or rendered moot. No issues remain. The Examiner is accordingly respectfully requested to place the application in condition for allowance and to issue a Notice of Allowability.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert E. Goozner, Ph.D. (Reg. No. 42,593) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

Pursuant to 37 C.F.R. §§ 1.17 and 1.136(a), Applicant(s) respectfully petition(s) for a three (3) month extension of time for filing a reply in connection with the present application, and the required fee of $1020.00 is attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Dated: August 18, 2005

Respectfully submitted,

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